

2 Combining the Concepts of Transdisciplinarity and Partnership in Research for Sustainable Development

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Abstract

The present article elaborates on the specific approach to and practice of research for sustainable development as conceptualised and implemented by the Swiss National Centre of Competence in Research (NCCR) North-South. At the core is the overarching understanding of sustainable development as a normative concept demanding goal-oriented collaboration among disciplines as well as co-production of knowledge at the interface of scientific communities and society. Transdisciplinarity, research partnerships, and a recursive research approach are necessary pillars in the quest to bridge disciplines and paradigms, as well as science and society in sustainability-oriented research. We argue that research for sustainable development faces major conceptual challenges related to system definition, linking to disciplinary discourses and progress, and bridging contextuality and generalisation, alongside operational challenges of conflicting reference systems, conflicting basic objectives, and complex science–society interfaces. With reference to the NCCR North-South we show how these challenges can successfully be dealt with. Finally, we argue that sustainability-oriented development research, transdisciplinarity, and research partnerships can be strengthened in science and knowledge societies by systematically addressing the basic challenges at the levels of scientific concepts and methodologies, underlying ontologies, and scientific and social interactions and collaborations, as well as at the level of management and communication. This will require major efforts within broadly based research networks backed by political commitment and support – as is the case in the NCCR North-South.

Keywords: Sustainable development; transdisciplinarity; research partnerships; knowledge forms; development research; science–society interface; contextuality; research management.

2.1 Introduction

There are many ways of defining and practising ‘development research’. The literature refers to research for development, research on development, development policy research, or, rather generally, international development studies (e.g. Habermann and Langthaler 2008; Sumner and Tribe 2008). The emphasis of the respective definitions and practices of development research depends considerably on the research community, their objectives, and the sources of funding available to them. Overall, development research is a hybrid, cross-disciplinary, pluralist field of inquiry which requires – but often lacks – specification of goals, approaches, and underpinning theories. This also holds true for research that specifically aims to contribute to sustainable development.

We argue that this lack of specification is a major reason why the vision and concept of sustainable development have not yet fulfilled their potential. Recent global assessments (e.g. MA 2005; UNDP 2005; IAASTD 2009) and shortcomings in the implementation of global approaches (Millennium Development Goals, United Nations Convention to Combat Desertification, United Nations Framework Convention on Climate Change, post-Kyoto process) clearly indicate that the global community has not progressed enough in efforts to mitigate problems of global change. Indeed, the world’s natural resources are still deteriorating, and the quest for equity is often contested and thwarted by short-term social, environmental, and economic problems (Rockström et al 2009). It is clear that the fundamental implications of reorienting and reorganising the interplay between science and society based on the concept of sustainable development are not easy to comprehend (Jäger 2009). Moreover, implementation of such a reorientation opens a box of challenges. Reflection on the theory of sustainable development and practical experience can help us to eliminate stumbling blocks and open avenues for conceptually sounder and societally more relevant research for sustainable development.

The present article elaborates on the approach to and practice of sustainability-oriented development research of the Swiss National Centre of Competence in Research (NCCR) North-South. This international research programme oriented towards ‘Mitigating Syndromes of Global Change’ has, since its inception in 2001, pursued a specific type of development research. This research is deemed to provide a better understanding of global development challenges characterised by multi-scale linkages and high complexity,

as well as ideas about how to mitigate these challenges (NCCR North-South 2002). At the core of the NCCR North-South's research approach is the overarching understanding of sustainability as a normative concept requiring societal co-production of knowledge at the interface of scientific communities and society (Hirsch Hadorn et al 2008; Pohl et al 2010). For the NCCR North-South, transdisciplinarity and research partnerships form two fundamental pillars in the quest to bridge disciplines and paradigms, as well as to link science and society in sustainability-oriented development research.

In this article, the authors aim to clarify and justify the conceptual links between 'sustainability-oriented development research', 'transdisciplinarity', and 'research partnerships', which are elements that are often mentioned as necessary in the context of development research but are seldom clarified (section 2.2). Drawing on a decade of experience, the authors point to core challenges in the theory (section 2.3) and practice (section 2.4) of sustainability-oriented research, and show how the programme responded to these challenges over time. Based on this analysis, the authors draw conclusions for the fairly young field of transdisciplinary sustainability-oriented development research.

2.2 Transdisciplinarity and partnership in sustainability-oriented development research

2.2.1 The value dimension in the sustainability concept

The declaration of the United Nations Conference on the Human Environment (UNEP 1972), followed by the adoption of the Brundtland definition of sustainable development (WCED 1987) and the declaration on sustainable development at the UN Conference on Environment and Development (United Nations 1992), have fundamentally changed the global agenda for policy on, and practice of, development and cooperation (Funtowicz et al 1998; UNESCO 2000). By linking equity with sustainability, the advocates of sustainable development inevitably framed a normative concept (Wiesmann 1995, 1998; Wiesmann et al 2008). This concept encompasses values and targets in three mutually dependent dimensions – the economic, socio-cultural, and ecological dimensions, visually captured in the 'magic triangle' of sustainability. These dimensions have to be weighed against one another in terms of trade-offs and symbioses in order to delineate how inter- and intra-generational equity can best be achieved. The sustainability concept

implies a reconceptualisation of the relation between science and society, making all accountable for realising a shared vision of inter- and intra-generational equity. As a sociopolitical model for societal change, sustainable development has been broadly taken up in science and policy (Becker 2000; Hirsch Hadorn et al 2006; Hirsch Hadorn et al 2008). Accordingly, ‘transdisciplinarity’ and ‘partnership’ have been framed as concepts to bridge science and society, and as a means to make research both a part and a driver of social learning processes for societal problem solving (Wiesmann 2009).

Ideas of transdisciplinarity and partnership in research are not new. Yet the concept of sustainable development has brought them to the fore (Meppem and Bourke 1999; Standing and Taylor 2007). Consequently, Northern approaches to combining knowledge systems, integrating stakeholders from society in attributing weight and value to knowledge generated by science, and conducting various types of action research have fruitfully been merged with a Southern perspective on integrating local actors into development agendas, bottom-up and participatory development, and local partnership (Wiesmann 2009; Zingerli 2010). The debate on complementarities between Northern and Southern theories of social action and societal transformation has generated new ideas on ‘reflexive learning’ between actors who belong to different systems of knowledge; such reflexive learning is conceived of as a dialogue between different ‘epistemic communities’ (Rist et al 2004; Hirsch Hadorn et al 2006; Rist 2007, pp 24–25). Indeed, development research has taken up the challenge of a ‘new contract’ between science and society, as Lubchenco (1998) termed the demand for a new commitment of researchers to tackling the problems of society in the 21st century (Jäger 2009). The resulting and far-reaching implications for research are considered and taken up by the NCCR North-South as described below.

2.2.2 Scope and relevance of transdisciplinary partnership approaches

The NCCR North-South views transdisciplinary partnership approaches as appropriate where strongly “coupled human–environment systems” – sometimes also referred to as “socioecological systems” (Young et al 2006, p 1) – are the basic unit of analysis. These systems are characterised by high complexity and insecurity. Despite the fact that progress in science and technology has broadened our capacity for intervention, understanding and controlling of system complexity is beyond our ability. Uncertainties even increase with new knowledge and experience, and scatter system boundaries. The normative concept of sustainability implies that only by attributing, nego-

tiating, and agreeing upon values are we able to identify the problems to be addressed, find ways to reduce system complexity – that is, delineate new system boundaries – and identify appropriate simplification and structuration that enable meaningful and goal-oriented scientific contributions (Sterman 2002; Hurni and Wiesmann 2004; Pohl and Hirsch Hadorn 2007). Otherwise, the system stays infinite, the complexity remains overwhelming, and interventions and impacts necessarily become random and unsustainable. As a result of the normative dimension of sustainability and the need for related social references, each socioecological system represents a unique case (Wiesmann and Messerli 2007). It is this contextuality that allows us to grasp the meaning and implications of ‘sustainability’, yet this same contextuality also limits the significance of results to basically one context. The NCCR North-South programme, however, has sought to go beyond the level of the unique case by synthesising contextualised insights, models, and approaches in order to achieve a level of generalisation about sustainable development.

2.2.3 Reconsidering knowledge: three knowledge types for sustainability

The concepts of sustainability and sustainable development have fundamentally reshaped our understanding of what knowledge is necessary for defining policies and strategies. It has been argued that knowledge is not always what is needed most for adequate action, and science has to be humble about its capacity to reach an understanding of the complexity of existence and succeed in managing it (see Hirsch Hadorn et al 2006; Stilgoe et al 2006). But far beyond this, the concept of sustainable development as a vision implies that the relevance of knowledge about ‘what is’ is tied to knowledge about ‘what ought to be’, and must be complemented with knowledge about ‘how to get there’ (Wiesmann 1998). These three questions refer to three knowledge types (ProClim 1997) that are taken up in the NCCR North-South as *systems knowledge*, that is, knowledge about contexts exposed to and reacting to global change; *target knowledge*, encompassing negotiated and agreed-upon values and goals; and *transformation knowledge*, which bridges what ‘ought to be’ and what ‘is’ by identifying the most adequate ways and measures for getting from the ‘is’ to the ‘ought’. Combining these knowledge types and reflecting on them makes it possible to respond in a flexible way to: (1) the complexity of the socioecological system despite a high degree of uncertainty with regard to system dynamics and impacts; (2) a broad range of conflicting stakes within societies, since it is a way of analysing and modifying the system that directly takes into account everybody’s interests and future life-world; and (3) determining the role of val-

ues as ethics and attitudes of stakeholders, by endorsing ‘what is’ and ‘what ought to be’. Such an understanding makes it obvious that even without contemplating the ‘real nature’ of reality, or truth, science has no monopoly on knowledge (Funtowicz et al 1998). But science and society are bound to enter into processes of knowledge generation and valuation for sustainable development. These processes require a transdisciplinary and partnership approach (Gallopín et al 2001; Hirsch Hadorn et al 2006; Bradley 2007; Zingerli 2010).

2.2.4 Transdisciplinarity

Within the NCCR North-South, transdisciplinarity is understood in terms of actor- and context-specific combinations of the three different knowledge types – systems, target, and transformation knowledge. This understanding incorporates three fundamental positions within the concept of transdisciplinarity (Thompson Klein et al 2001; Hurni and Wiesmann 2001; Wiesmann et al 2008): (1) Transdisciplinarity intends to build bridges in the world of science. Here, mainly in the generation of systems knowledge, transdisciplinarity goes beyond interdisciplinary approaches (of often neighbouring disciplines) by integrating the natural, technical, and social sciences and the humanities – notably disciplines separated by different epistemological paradigms. (2) Transdisciplinarity intends to bridge science and society. As a consequence, researchers and other actors have to play their respective part in social and political processes for sustainable development. Their new roles are basically defined by the fact that sustainable development can only be meaningfully understood and negotiated in a specific socioecological context by taking into account the values and knowledge of the actors involved. (3) As a combination of the first two positions, transdisciplinarity is devoted to the question of how best to organise co-production of knowledge and social learning processes at the interface of science and society.

As for sustainable development, neither the problem itself nor ways of solving it can be formulated in advance. The contributions of scientific disciplines are not predefined; research designs, their institutions, interaction, and procedures undergo constant modification. This ‘new way of doing research’ implies neither a hierarchy within science nor the replacement of disciplinary or interdisciplinary research by transdisciplinary research (Wiesmann et al 2008; Herweg et al 2011). Disciplinary contributions are embedded in sustainability-oriented research in a reflexive and recursive process. The rationale for bridging disciplines and disciplinary paradigms as well as science and society strongly binds transdisciplinarity to a partnership approach.

2.2.5 Research in partnership

Very early in the discourse on sustainability, a consensus emerged about the value of ‘equitable development’. This implies a need for reflecting on power issues not only with regard to the goals of sustainable development, but also regarding ways to achieve such development (Zingerli 2010). Basically, the transdisciplinary partnership approach within the NCCR North–South responds to the need to link disciplines as well as science and society and to make transdisciplinarity operational. The partnership component mainly consists of a North–South and South–South network of partners (Upreti et al, in press). The programme intends to combat the profound lack of integration of perspectives, perceptions, and values of countries in the South in the conceptualisation and implementation of sustainable development. Thus it also addresses the quest for correcting global development disparities, which are extremely pronounced in the realm of research (UNESCO 2010), and the quest for devolution of power from usually dominant, Northern science-based research programmes to participating institutions and partners of the global South (KFPE 1998, 2009; Hurni and Wiesmann 2004; Bradley 2007). Many of the collaborating partner institutions and organisations in the programme not only engage in academic research but also establish connections with policy, implementation, and advocacy. In development research, networks consisting of academic and non-academic members require various modes of knowledge co-production (Gibbons et al 1994; Sumner and Tribe 2008). Such interaction allows not only for negotiating values, goals, and strategies of sustainable development and organising adequate structures and processes of interaction and exchange, but also for reducing the tensions between shared concepts (consensus) and maintaining required and acceptable differences (dissent) between the partners involved. As a consequence, working in partnership increases the relevance of research contributions to sustainable development and enables researchers to try and meet basic ethical demands such as enhancing equity, ownership, and transparency within partner institutions.

2.2.6 Challenges in reflective and recursive research processes

To summarise, research for sustainable development has to be conceptualised and practised in a manner different from conventional approaches to basic, disciplinary, and interdisciplinary research. The difference lies in integrating analytical and normative knowledge. The question of how to realise such integration bears profound challenges for the scientific community. The NCCR

North-South has been responding to this need by supporting joint reflexive and recursive research processes at the science–society interface (Dumoulin 2005). The rationale is to make explicit and negotiate values and norms, integrate different forms of knowledge, and attribute weight and value to knowledge generated by science in order to produce socially acceptable, broadly based, high-quality, and sustainable solutions. Such a process involves restructuring of problems and modification of assumptions, which in turn calls for a research design that is basically recursive (Wiesmann et al 2008).

Although the combination of transdisciplinarity and research partnerships provides a conceptually sound basis for such research, no formula or blueprint exists for how to make this combination operational. Moreover, in practice researchers obviously face a broad range of epistemological and operational challenges that affect not only them but also all other parties involved. In what follows, we capitalise on the NCCR North-South’s experience of implementing transdisciplinary research in partnership. This rich experience provides insights into the specific epistemological and practical challenges facing transdisciplinary research partnerships for sustainable development, as well as pathways for tackling these challenges.

2.3 Coping with conceptual challenges of sustainability-oriented research in partnership

2.3.1 Three major conceptual challenges

Acknowledging that the concept of sustainable development combines a value perspective (the ‘ought to be’) with a systemic perspective (the ‘is’) has implications for the operationalisation of this concept in research and practice. Some of these implications prevent sustainability-oriented research from making meaningful contributions (Wiesmann and Messerli 2007). In the process of conceptualising the NCCR North-South programme, three of these challenges received special attention:

1) The challenge of system definition: This challenge is related to the need for defining a system as the relevant analytical unit of sustainability-oriented development research. As long as the system to be addressed remains infinite and vague, any conclusion or intervention is in danger of being arbitrary. Additional scientific efforts might then solely provide more insight into overwhelming complexity and uncertainty, without detecting pathways for sustainable development. The way out is to

keep in mind that a “system” is basically a model (Stermann 2002) which depends on the problems or questions we have. Consequently, the general quest for ‘sustainable development’, which leads to an infinite system definition, has to be specified to a level that enables a researchable definition of elements, relations, and boundaries of the system. In other words, the more clearly the goals of sustainable development are formulated, the more clearly the analytical unit can be delineated. To put it bluntly, the key to system definition in sustainability-oriented research lies in the normative dimension of sustainable development, and not in its systemic dimension. Negotiating the normative dimension in partnership therefore becomes an essential foundation for sustainability-oriented research.

2) The challenge of linking transdisciplinary research to disciplinary

progress: Due to the normative dimension of sustainability, research for sustainable development ultimately has to be transdisciplinary. However, as outlined above, transdisciplinarity is neither a new nor a meta-discipline; its quality depends – besides the science–society interface – largely on the quality and integration of disciplinary contributions and underlying theories. Experience shows that this quality is frequently jeopardised in sustainability-oriented research by undertheorised forms of holism, a discourse trapped at a meta-theoretical level, or a retreat into simple pragmatism. For this reason, transdisciplinary practice often lags behind disciplinary discourses and is unable to incorporate disciplinary progress in terms of insights, and even less so in terms of theories and methodologies. The resulting danger of amateurism also strongly restricts the innovative potential that transdisciplinary endeavours can have for the participating disciplines (Wiesmann et al 2008). This challenge requires close consideration of how to define the system as well; indeed, the more clearly the system is defined, the more adequately will disciplinary concepts be linked with the research endeavour. Therefore, in multidisciplinary partnerships, negotiating and reflecting on the normative dimension of sustainability and its consequences for the definition of the system, as well as on the system’s linkages to the theories and ontologies underlying disciplinary methods and tools, become a key to high-quality research for sustainability.

3) The challenge of contextuality and generalisation: This challenge results from the fact that sustainability, or the ‘ought to be’, can only be defined in concrete sociopolitical contexts through the attribution by the people concerned of values related to development. This contextuality of the normative dimension implies that any sustainability-oriented endeavor

our – at whatever scale – is basically a unique case; thereby it limits the possibility of generalising results. Generalisation through formulation of sustainability principles or through the dissemination of successful and usually sectoral sustainability measures may have practical importance. Yet there is a need for more profound solutions that reduce the tension between the contextuality necessary in sustainability-oriented endeavours and the generalisation required in them. Theoretical, conceptual, and methodological development of generalisation is therefore a prerequisite to increasing the practicability, quality, and relevance of sustainability-oriented development research.

2.3.2 Meeting conceptual challenges in the NCCR North-South

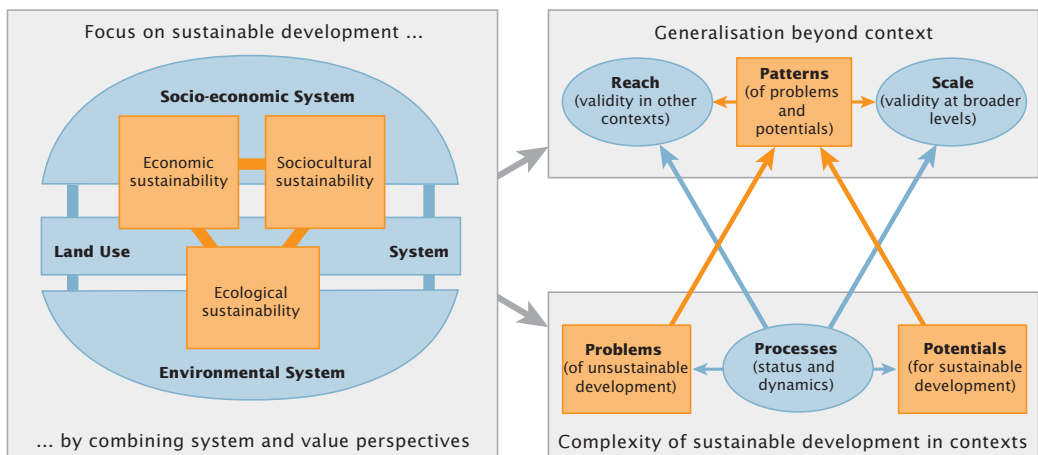
At the outset of the NCCR North-South, these conceptual challenges were taken into account by introducing the so-called ‘syndrome concept’. This conceptual framework aimed to form the bracket for sustainability-oriented research in three major contexts (semi-arid areas, highland–lowland systems, urban and periurban areas) in nine partnership regions or ‘Joint Areas of Case Studies’ (JACS)⁵ on four continents. The concept of syndromes of global change had originally been proposed by the German Advisory Council on Global Change (WBGU 1997) and the Potsdam Institute for Climate Impact Research (PIK) (Schellnhuber et al 1997; Petschel-Held et al 1999), but was significantly modified to incorporate the normative dimension of sustainable development and to frame the sustainability-oriented research of the NCCR North-South (Cassel-Gintz 2003; Hurni et al 2004).

The basic assumptions of the modified syndrome concept are twofold. First, it is assumed that it is easier to negotiate the normative dimension of sustainability by naming problems of unsustainability than by defining sustainability targets. If, in addition, the concrete manifestation and severity of such problems in specific contexts is left aside, a list of core problems of unsustainable development can be negotiated between different contexts that form a comparative basic set of variables for sustainability-oriented research. Second, it is assumed that the concrete manifestations of several of these problems can be similar in different contexts, thus forming specific clusters or patterns of core problems. Such a pattern of core problems is called a syndrome of unsustainable development. It can be hypothesised that similar processes and dynamics underlie a syndrome. In other words, the normative dimension of sustainable development is captured by patterns of core problems, and the systemic dimension by the hypothesis of similarities

in the underlying dynamics of global change and contextual responses. This basic concept was further extended by supplementing patterns of problems with patterns of potentials for more sustainable development. This, in turn, made it possible to include the dimension of transformation knowledge. The ‘syndrome concept’ was thus reconceived by the programme as a conceptual framework for mitigating syndromes of global change. In sum, the syndrome concept of the NCCR North-South aimed to respond to (1) the challenge of contextuality and generalisation through its pattern component; and (2) the challenge of system definition through a process of negotiating core problems of unsustainable development and potentials for sustainable development; therefore (3) it also aimed to lay the foundations for linking transdisciplinary research to disciplinary theories (Figure 1).

Most crucial in framing sustainability-oriented research was a major participatory research effort at the outset of the NCCR North-South to negotiate and define a list of core problems of unsustainable development among all partners and partner regions of the NCCR North-South (Hurni et al 2004; Wiesmann and Hurni 2004). The participating researchers and regional representatives came up with a list of 30 core problems grouped in five scientific realms (Table 1). The joint negotiation process allowed for delineating the system boundaries, identifying the problems at stake, and setting the starting point for a common research agenda. Most importantly, negotiated results represented the views from both the North and the South, creating a broadly based ownership of the NCCR North-South research approach. In addition,

Fig. 1
Conceptual framework for mitigating syndromes of global change: contextuality and generalisation in sustainability-oriented research. Blue elements pertain to the systemic perspective, orange elements to the normative perspective. (Source: NCCR North-South, internal documents; Wiesmann 1998, 2008)



it enabled the development of specific regionally based JACS research strategies and outputs (Hurni and Wiesmann 2010) without jeopardising cross-JACS collaboration and synthesis. As an open framework the syndrome concept made it possible for joint reflection and adaptation of the research design to take place continually over time. For the participating scientific disciplines, the negotiated definition of core problems of unsustainability enabled a clear framing of disciplinary contributions, for example through PhDs, against the background of a broader common view of problems and the corresponding systems. This triggered not only inter- and transdisciplinary collaboration in the empirical research that was initiated, but also debates on underlying theories and ontologies (Dumoulin 2005). In several cases, this cross-disciplinary reflection led to generic and innovative contributions to global theoretical debates, for example the contribution to the emerging concept of “resilience” in several disciplines (Obrist et al 2007) or the concept of “one health” (Schelling et al 2008; Schelling et al 2009).

In sum, in nine years of NCCR North-South experience, the syndrome concept proved to be an important tool for overcoming crucial conceptual challenges of sustainability-oriented research and a means of framing transdisciplinarity and research partnerships within the programme. We can state that the conceptual framework of the NCCR North-South was (1) theoretically sound enough to enable mastering of the three above-mentioned conceptual challenges facing sustainability-oriented research, (2) unifying enough to trigger high-quality transdisciplinary collaboration and balanced and reflexive partnerships, and (3) open and flexible enough to accommodate innovative disciplinary and interdisciplinary, as well as contextually rooted contributions to more sustainable development. On a critical note, one could add that the term adapted from WBGU (1997) and the original concept of ‘syndrome’ placed too much emphasis on problems and did not sufficiently showcase the development potentials upon which the NCCR North-South has also strongly been focusing. In addition, systematic analysis of the patterns of problems, potentials, and processes analysed in the individual research projects has not yet been concluded, leaving room for further conceptual development. However, comparisons of patterns have already been conducted for a wide range of topics, enabling the NCCR North-South to make substantial synthesis contributions to current debates on global issues of sustainable development.

Table 1

Scientific realms	No.	30 core problems
Political and institutional	1	Weak international geopolitical position and negotiation power
	2	Dominating and conflicting world views and ethical values
	3	Contradictory policies and weak formal institutions at different levels
	4	Inadequate legal framework and regulations, lack of enforcement and means
	5	Erosion of traditional and/or indigenous institutions
	6	Governance failures, insufficient empowerment and decentralisation
	7	Unequal distribution of power and resources, corruption
Sociocultural and economic	8	Social, cultural, and ethnic tensions and insecurity
	9	Prevalence of crime, violence, and violent conflicts
	10	Unused or restricted innovative capacities and knowledge
	11	Great socio-economic and gender disparities
	12	Incompatible and fragile economic systems with limited market and employment opportunities
	13	Dominance of the global economy over national development
Population and livelihoods	14	Restrictions on human rights and individual development potential
	15	Poverty and livelihood insecurity
	16	Health risks and vulnerability to ill health
	17	Population pressure and multidimensional migration
	18	Unfavourable dynamics and imbalances in sociodemographic structures
Infrastructure, services, and land use	19	Poor water supply and environmental sanitation
	20	Lack of adequate infrastructure and management (e.g. transport, energy, and irrigation)
	21	Limited and inadequate socio-economic services such as education, health, and markets
	22	Discrimination in information and communication flows and technologies
	23	Inequality of ownership and access to land, natural, and common-property resources
	24	Inadequate and conflicting land use systems and technologies
Biophysical and ecological	25	Inadequate availability of freshwater
	26	Degradation of land, soil, and vegetation cover
	27	Degradation of forests and other natural habitats
	28	Pollution and overuse of renewable and non-renewable natural resources
	29	Loss of biological and agrobiological diversity
	30	Risks of natural and human-induced hazards and climate change

Core problems of unsustainable development as negotiated and defined in nine Joint Areas of Case Studies (JACS).

2.4 Coping with operational challenges in transdisciplinary partnership-based research

2.4.1 Three important operational challenges

We have argued that sustainability-oriented development research ultimately requires a transdisciplinary and partnership approach based on sound disciplinary contributions. This implies major operational challenges that are rooted in the social constellations and interfaces typical for transdisciplinarity and partnerships, including the intercultural dimension of research partnerships, the need for crossing epistemological borders in interdisciplinary collaboration towards sustainable development, and the difficulty of dealing with a science–society interface in which power relations tend to dominate knowledge relations (Pohl et al 2010). This triple social exposure of sustainability-oriented research implies that the related operational challenges are significantly more pronounced than in disciplinary research endeavours. In the course of conceptualising and running the NCCR North-South programme, three major operational challenges received special attention.

1) The challenge of conflicting reference systems: Due to the multiple social embeddedness of sustainability-oriented research, individual researchers and whole programmes are exposed to a range of highly conflicting reference systems. Among these reference systems are: (1) disciplines and respective academic home institutions, where careers and positions are determined by the level of disciplinary contributions and their recognition within the system of peers, (2) the interdisciplinary research team and the partnerships involved, where merits stem from the capacity to collaborate and produce goal-oriented contributions, although these receive less formal recognition in academia, and (3) the society concerned, its stakeholders, decision-makers, and commissioning agencies, as well as each researcher's own livelihood background, where outcomes in the form of societal uptake may be recognised, but are difficult to assess. These reference systems do not coincide at all. At the individual level, the researcher is under pressure regarding whom he is responsible to and to what degree. Depending on the team members' career stages and their scientific and cultural background, they will respond differently to these tensions and set different priorities within the various reference systems. This may lead to misunderstandings and even to conflicts within teams and projects – a danger which is even greater in intercultural partnerships. Commonly, conflicting reference systems lead to two reactions, both of which

reduce the quality of transdisciplinary endeavours. First, the pressure to perform disciplinary and interdisciplinary outputs and outcomes is internally – and externally – increased to a level where reproduction tends to replace innovation. Second, the profiles and roles of individual researchers are cemented according to their disciplinary origins or along gender or North–South divides to a degree that cross-disciplinary communication is easily interpreted as trespassing, thereby hindering interdisciplinary innovation. The way out of this challenge is to find an appropriate mix between compulsory and open components within transdisciplinary and partnership-based research endeavours that enable a balance between individual and collective orientations. A clear phasing of these components is essential, implying that socially sensitive allocation of time and sequencing in timing become key concerns and key factors of success.

2) The challenge of conflicting objectives: The triangle of innovative research, capacity development, and societal impact very often forms the basic goal orientation of transdisciplinary and partnership-based research endeavours, and in fact, many commissioning agencies explicitly demand a focus on this triple goal (Figure 2). The corresponding assumption is that high-quality research leads to high societal relevance and is accompanied by significant capacity development. However, experience has

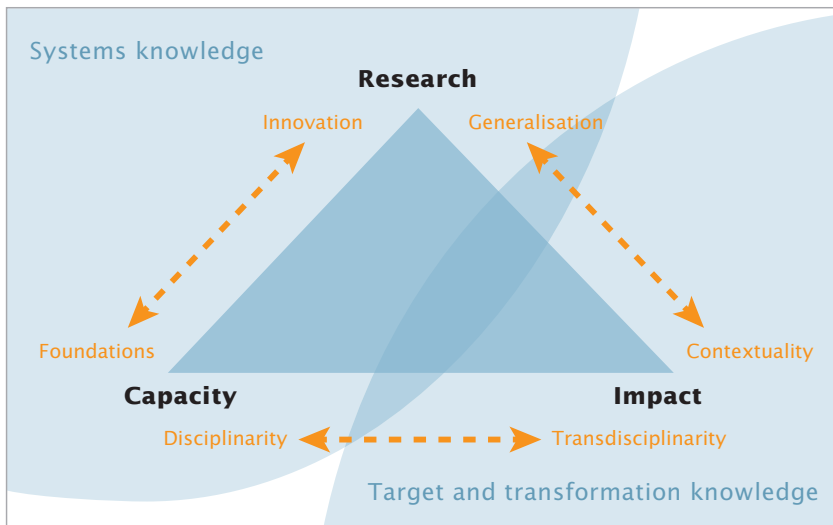


Fig. 2
Conflicting basic
objectives of
sustainability-
oriented research
endeavours.

shown that these goals are in conflict: High-quality research has to deal with the ‘unknown’ at the forefront of knowledge and aims to produce findings that can be generalised, whereas capacity development requires concentration on consolidated knowledge and methodologies, and societal relevance and impact are based on concrete, contextualised knowledge and innovations. In addition, research and capacity development tend to focus on understanding processes and dynamics in the sense of systems knowledge, whereas society expects answers regarding what can be done, therefore demanding increased target knowledge and particularly transformation knowledge. These conflicting orientations are also reflected in the disciplinary composition: While capacity development primarily requires concentration on disciplinary foundations, innovative research findings often emerge at or across the boundaries of established disciplines, and high societal relevance requires science–society interfaces in the sense of transdisciplinarity and negotiated values. Facing the challenge of conflicting objectives requires well-balanced phasing and structuring of respective research endeavours in components suited to generate outputs as well as outcomes in line with all three basic objectives: innovation, capacity development, and societal impact.

3) The challenge of the science–society interface: Unless one takes the widespread but untenable attitude that – predominantly male and Northern – researchers and experts represent all relevant societal values and can therefore define the normative dimension of sustainable development, science–society interactions become a necessity in sustainability-oriented research. However, the required science–society interface is caught between two contradicting poles. On the one hand, concrete sociopolitical development contexts are usually characterised by a broad range of conflicting values and complex power relations that are intensified in developing countries by countless stakes and demands of development agencies and other stakeholders. On the other hand, the peripheral political position of development cooperation in Northern societies and the weak position of transdisciplinarity in science imply that sustainability-oriented research faces a dual marginalisation in science and society. This dual marginalisation provokes an externally and internally driven pressure on output, visibility, and success that hinders adequate attention to the complexity of the concrete sociopolitical contexts. This, in turn, increases the danger that the science–society interface in transdisciplinary endeavours may be reduced to superficial participation or to purely demand-driven and largely power-insensitive approaches. The way out is to phase and structure sustainability-oriented research in a way that allows for well-defined and concentrated

science–society interactions, and to embed research endeavours in long-term and contextually rooted partnership networks.

2.4.2 Meeting the operational challenges in the NCCR North-South

When the NCCR North-South was initiated and designed, major operational challenges were generally anticipated, but their full weight was only discovered and felt in the course of the programme's execution. Due to its anticipated duration of three four-year phases, as well as to the bottom-up approach underlying the Swiss NCCRs, it was, however, possible to steer and adapt the programme and its structure periodically in a participatory manner, with a view to mastering the operational challenges described above. The following operational measures of packaging and phasing proved to be essential:

1) Sequencing modes of knowledge production: One basic assumption was that transdisciplinary research has to build on disciplinary and interdisciplinary contributions and that, accordingly, adequate time and space have to be allocated for these contributions. This was taken into account by designing periods in the NCCR North-South programme where transdisciplinarity prevailed, and other periods with a concentration on disciplinary and interdisciplinary work (Figure 3). The transdisciplinary negotiation and definition of core problems of unsustainable development that marked the start of the NCCR North-South (see section 2.3.2) set the frame and paved the way for sound and innovative disciplinary research in the following periods. In addition, it was anticipated that not

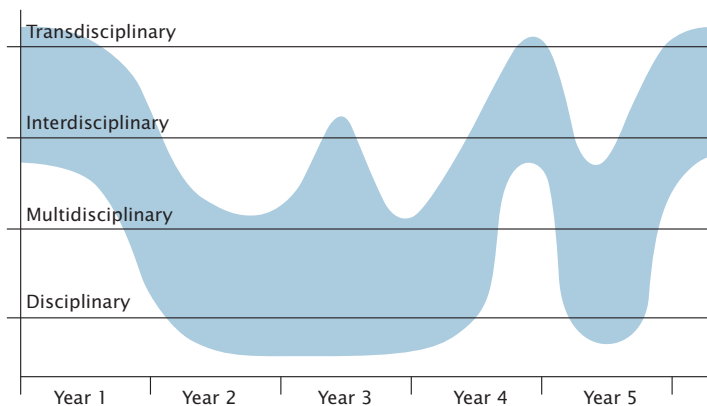


Fig. 3
Variation of modes
of knowledge pro-
duction in the
course of a
transdisciplinary
research endeav-
our. (Source: Hurni
and Wiesmann
2004)

all researchers would need to master all modes of knowledge production to make the NCCR North-South a transdisciplinary endeavour: PhD and post-doctoral research was designed to concentrate on disciplinary research into the topics previously defined in transdisciplinary negotiations, supported by a basic knowledge of transdisciplinarity acquired in integrated training courses. These measures made it possible to master the challenge of conflicting reference systems and to enable participating researchers to build individually adapted careers inside and outside academia. Results from interviews with former researchers (Zingerli et al 2009; Upreti et al, in press) indicate that participation in the transdisciplinary endeavour of the NCCR North-South did not jeopardise but rather promoted careers in both the North and the South.

2) Varying complexity of research components over time: To allow iterative balancing of the conflicting basic objectives mentioned above and adequate configuration of research teams and the science–society interfaces at regular four-year programme intervals, the packaging of the NCCR North-South into research components changed over time. In the first phase, eight disciplinary and institutionally based *Individual Projects (IPs)* were the main components, enabling research groups to create their position within, and ownership of, the overall programme. In the second phase, these individual projects were regrouped into four *Work Packages (WPs)* and a *Transversal Package (TP)*, in order to increase the emphasis on interdisciplinary collaboration and cross-cutting scientific synthesis. Each WP dealt with specific aspects of syndromes of global change and focused on a particular interdisciplinary field in several regions. The TP further developed the theoretical, conceptual, and methodological foundations of the programme. Finally, in the third, still active phase, 16 competitively established *Research Projects (RPs)* were initiated. These RPs are co-led by Northern and Southern researchers; they address core issues of sustainable development based on comparison between regions and using disciplinary and interdisciplinary methodologies. These research projects are an expression of the stage of maturity that the NCCR North-South has reached in balancing conflicting reference systems, enabling innovative and goal-oriented collaboration in partnership, and finding a balance between a unifying overall conceptual framework and the freedom required to foster innovation.

3) Components of integration and impact: In addition, the NCCR North-South established a number of components that are based on the consideration that sustainable development requires contributions situated at various positions between the poles of contextualisation and generalisation, as well as specialisation and application (Hurni and Wiesmann 2011, in this volume). Three of these components were successfully maintained throughout the lifespan of the NCCR North-South and proved to be essential in mastering the operational and scientific challenges of the programme (Figure 4):

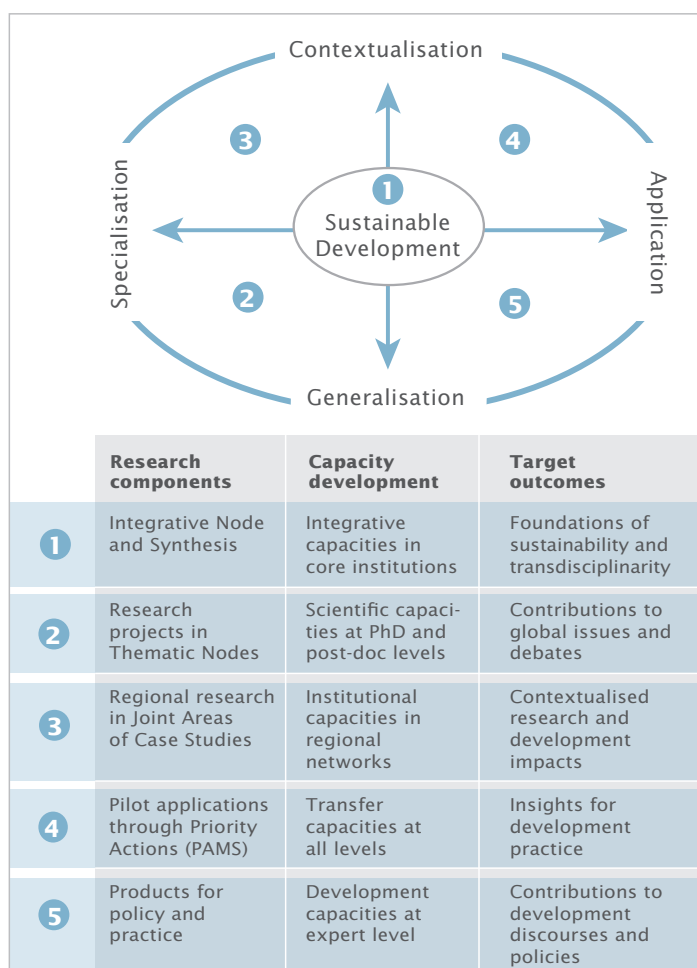


Fig. 4
Goal-oriented packaging of the NCCR North-South and its relation to the objectives of sustainability-oriented research, capacity development, and societal impact.

- *Priority Actions for Mitigating Syndromes of Global Change (PAMS)* were established to test the application of results and recommendations in pilot development projects. Besides having positive and concrete impacts, PAMS proved to be essential in training individual researchers and in informing the overall programme about how to adequately address the science–society interfaces (Messerli et al 2007; Heim et al 2011).
- *Joint Areas of Case Studies (JACS)* were established in nine regions around the world, primarily to enable contextualised interdisciplinary and partnership-based research collaboration. The JACS, however, proved to be much more than frames for North–South research partnerships. Not only did they develop into important training and scientific coordination nodes, but they also emerged as triggers of an increasingly Southern-driven agenda setting in the programme, and as pivots of growing South–South and South–North collaborative research networks that go beyond the NCCR North-South. In relation to transdisciplinarity, many JACS institutions have now also become absolutely crucial for well-balanced, participatory, and power-conscious science–society interfaces and are therefore the most essential programme component for concrete societal outcomes and uptake of the sustainability-oriented research of the NCCR North-South (Upreti et al, in press). This was made possible by the strong contextual and institutional anchoring of some JACS, and, in particular, through the long-term research partnerships that were built on the basis of the KFPE principles for such collaborations (KFPE 2009, 2011).
- Finally, the *Management Centre (MC)* – in conjunction with the *Regional Coordination Offices (RCOs)* – has played a key role in mastering the operational challenges mentioned above. Originally established to facilitate scientific collaboration and capacity development through a broad range of services – among which its integrative training component has been felt to be particularly successful – the MC increasingly emerged as a key component in the transdisciplinary science–society interface, in particular in the North and at international and global levels. This was based on the insight that the manifold roles of facilitators, moderators, or brokers in this interface cannot be left solely to the researchers but require specific and professionalised capacities supporting the various research teams and opening avenues for recognition, outcomes, and impacts.

Figure 4 illustrates that the various programme components mentioned above not only allow for specific foci and concentration of research in the

field delineated by the poles of contextualisation and generalisation and the poles of specialisation and application in sustainability-oriented research, but that they also enable specific orientation of capacity development, as well as targeted outcome and impact orientation.

In sum, the packaging and phasing of the NCCR North-South has evolved in such a way as to optimise response to the key operational challenges of conflicting reference systems and conflicting basic objectives (research, capacity, impact), as well as of the complex science–society interface. Basic structures were built that play a key role in mastering these challenges – in particular the network of JACS, the instrument of PAMS, and the professionalised management structures. Based on these, structurally flexible research projects and initiatives can respond in an innovative way to issues of sustainable development and respective societal demands. On a critical note, it must, however, be added that the basis for the exemplary mastering of key challenges by the NCCR North-South both structurally and institutionally is not consolidated and almost entirely depends on time-bound project funds. This is particularly true for the long-term research partnership network sustained by the JACS. If no structural support in academia and/or development cooperation can be found for this high-quality transdisciplinary network, the danger of losing key assets for sustainability-oriented research will be high.

2.5 Conclusion

In development research in general and in sustainability-oriented development research in particular, both the quality and relevance of research greatly depend on the capacity to integrate the normative perspective of – sustainable – development and link it to the largely systemic perspective of science. We have argued that this necessarily implies a transdisciplinary mode of knowledge production that bridges disciplines and paradigms and includes science–society interfaces, thus leading to generation of systems, target, and transformation knowledge. Such development-related transdisciplinarity requires research partnerships between the global North and the global South. Given these premises, we have shown that sustainability-oriented development research faces major conceptual challenges of system definition, of linking transdisciplinary research to disciplinary debates and progress, and of bridging contextuality and generalisation, alongside the operational challenges of conflicting reference systems, conflicting basic objectives, and complex science–society interfaces.

The NCCR North-South successfully dealt – and continues to deal – with these major challenges. We have pointed out the crucial role of a flexible, unifying, and reflexive conceptual framework – in this case the syndrome mitigation concept – as well as the need for iteration between disciplinary, interdisciplinary, and transdisciplinary modes of knowledge production. We have also highlighted the crucial role of contextualised and long-term research partnerships, as well as the need for structural components that specifically address aspects of the said challenges through participatory processes jointly steered by the partners.

Due to its duration and size, as well as to the enabling support provided by the Swiss National Science Foundation (SNSF) and the Swiss Agency for Development and Cooperation (SDC), the NCCR North-South was and is a unique case for testing, studying, and implementing the requirements for innovative, scientifically sound, and societally relevant sustainability-oriented development research, transdisciplinarity, and research partnerships. It has become clear that these requirements are interdependent and challenging at the levels of scientific concepts and methodologies, underlying ontologies, scientific and social interactions, and collaboration in complex settings, as well as at the level of management and communication. Facing these requirements contributes to increasing the scientific quality and relevance of sustainability-oriented research and to sharpening the profiles of transdisciplinarity and research in partnership that are required by an orientation towards sustainability. In conjunction with advocacy and the continual building of peers, this honing of a clear profile and production of quality output will hopefully strengthen the still rather weak position of transdisciplinarity and related partnership approaches in the scientific community and in knowledge societies (Hirsch Hadorn et al 2008).

It can therefore be concluded that cutting-edge sustainability-oriented development research cannot be meaningfully conducted in short-term projects that are either treated as an applied offspring of conventional disciplinary research or that are driven exclusively by the demand coming from commissioning agencies. Such research requires underpinning academic and institutional structures with sufficient critical mass, as well as stability – a requirement that is valid for participating Northern partners but is even more important for partners in the global South. Investment by science and development actors into building and maintaining such structures is therefore an important, relevant, and highly effective contribution to sustainable development.

Endnotes

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⁵ The NCCR North-South partnership regions are also known as Joint Areas of Case Studies (JACS). Regional Coordination Offices (RCOs) were established in each of these JACS at the outset of the programme. The original function of the RCOs was to coordinate research; in the ongoing final phase of the programme, RCOs are working to consolidate the existing research network in the South and function as knowledge hubs for generating new research projects and partnerships.

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